

# Altair

Subject: 9th BIOLOGY

Class: Lab Basics:

The Tools of Research

Date: March 25

# 2011



Teacher's notes

Objectives

Vocabulary

Link and Learn

Prepared by

# Science in the Works

- Science is a dynamic discipline, there is always somebody looking for new things or new ways to do things.
- In order for scientists from different disciplines learn about new things, they need to get their hands on laboratory equipment and research techniques.
- These equipments can be very simple (tube) or very complex (electronic sensors).
- The research techniques can also be very simple (mixing) or complex (isolation of individual molecules).
- Let's review some of the most common and used laboratory equipment and techniques.



Let's concentrate  
only on one  
scientific discipline



# BIOLOGY

*Is the study of living things, is the science of life.*



## *To study cells, biologists use microscopes and the tools of biochemistry*

- Understanding the cellular world demands that scientists look at microscopic entities and structures such as cells and its components.
- **Can you name 3 instruments/equipment biologists must use to study cells?**

1

2

3

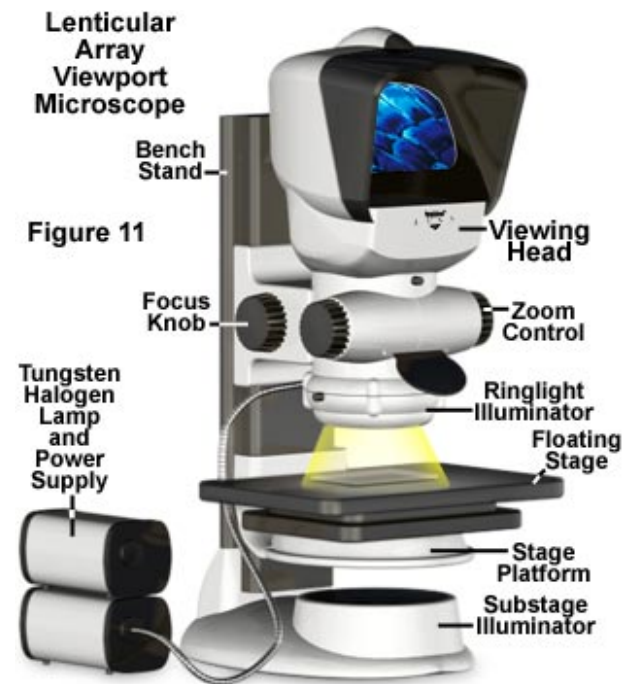


# MICROSCOPY

- The advance of a scientific field often parallels the invention of instruments that extends human senses to new limits.
- The discovery and early study of cells progressed with the invention of microscopes in 1590 and their improvement in the 17th century.
- Microscopes of various types are still indispensable tools for the study of cells.



<http://goo.gl/cykX4>

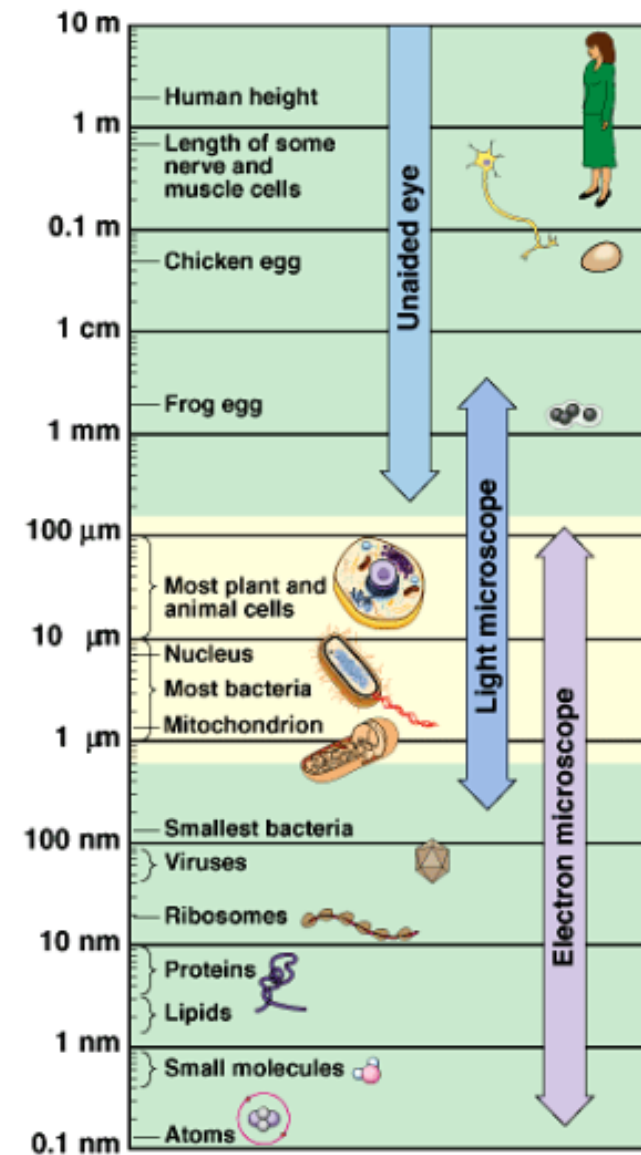


<http://goo.gl/4cBJL>



# A Sense of Scale

<http://goo.gl/qc7Yf>



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<http://goo.gl/jzZSQ>

# Types of Microscopes

## LIGHT MICROSCOPE

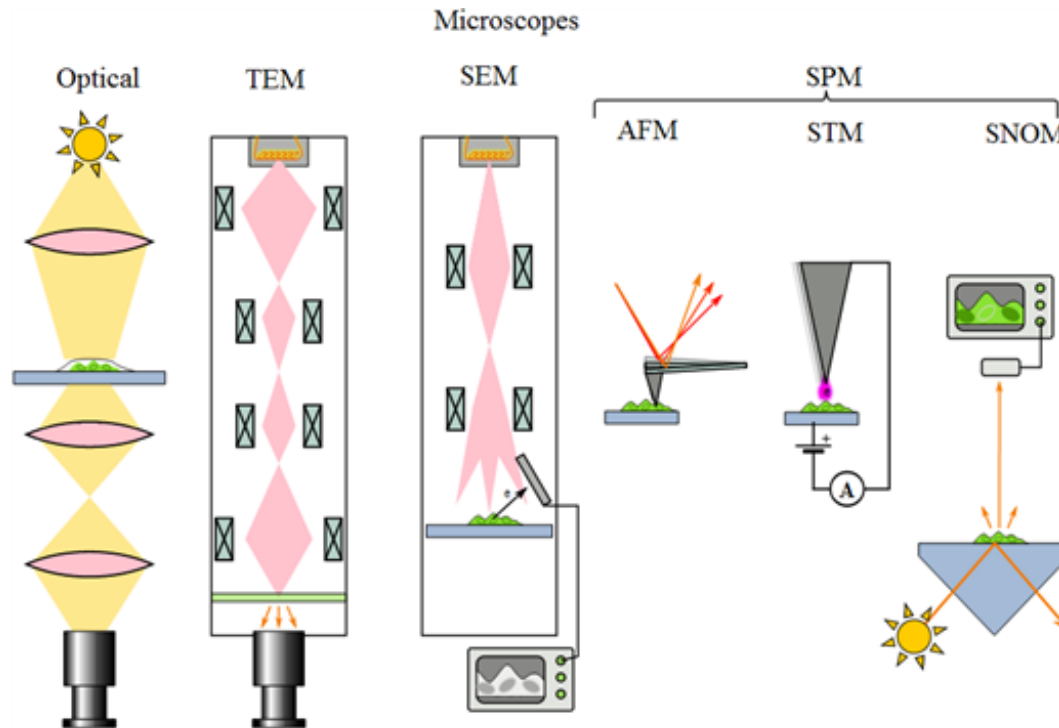
Is an optical microscope that uses the light to image the sample.

## ELECTRON MICROSCOPE

Is a microscope that uses an electromagnet lens to image the sample.

## SCANNING-POINT MICROSCOPE

It forms images of surfaces using a physical probe that scans the specimen.



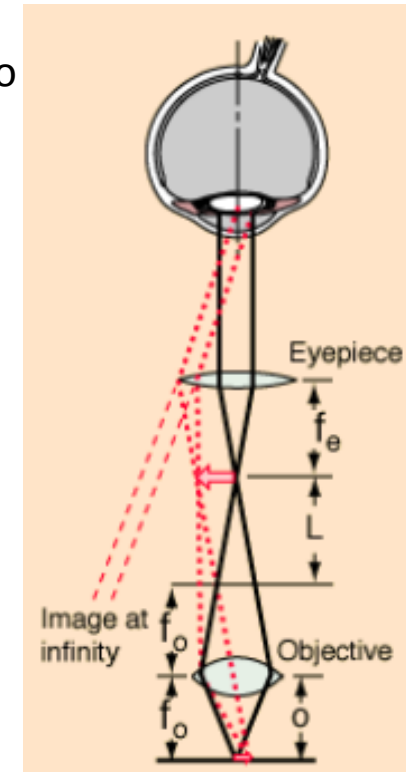
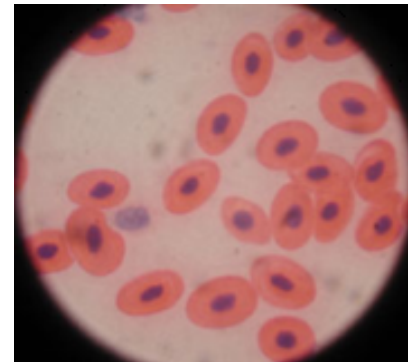
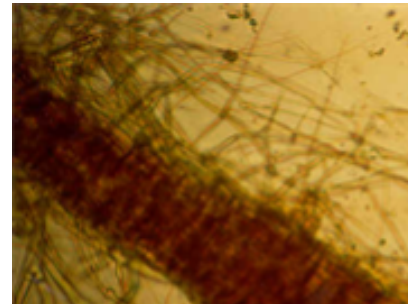
<http://goo.gl/LHeOK>



# OPTICAL MICROSCOPY

## COMPOUND MICROSCOPE

A compound microscope uses a very short focal length objective lens to form a greatly enlarged image. This image is then viewed with a short focal length eyepiece used as a simple magnifier. The image should be formed at infinity to minimize eyestrain.



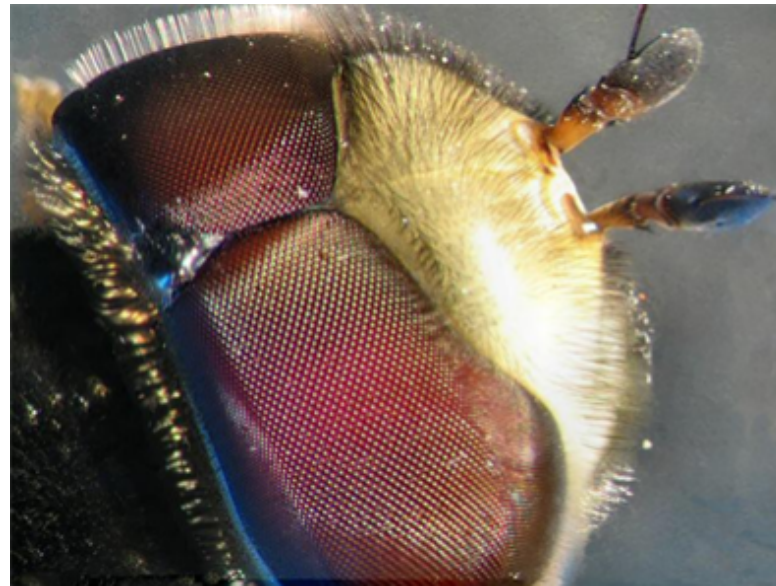
<http://fur.ly/59jz>



# OPTICAL MICROSCOPY

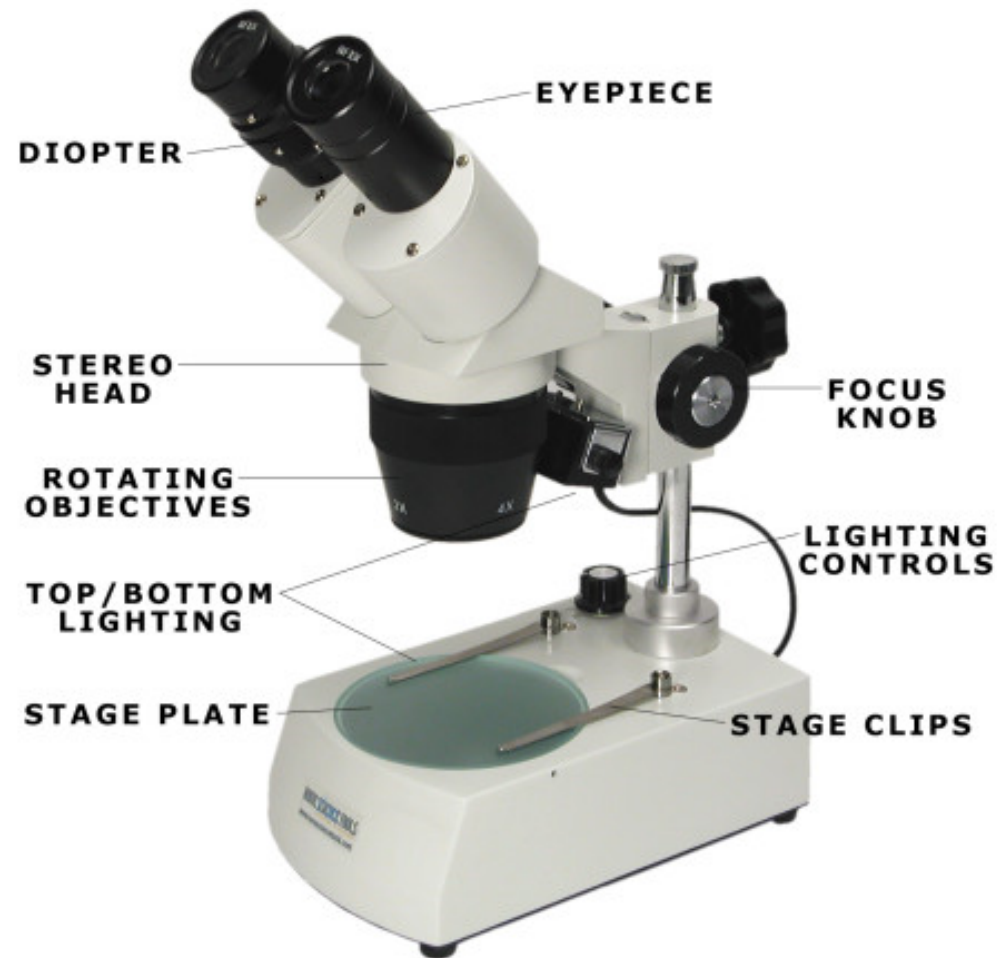
## **STEREO MICROSCOPE**

The stereo microscope is used for detailed three dimensional vision. Catching the light with two objectives, stereo microscope allows better studies of thick specimens. Capable of dark field observations stereo microscope functions by means of two separate light beams making the visual stereo effect. Stereo microscopes are not very powerful though, their useful magnification is not greater than 100 and 10 times in the average use.



<http://fur.ly/59k2>

## What type of samples can be used for this microscope?



Identify the parts of this microscope



# **ELECTRON MICROSCOPY**

- **It focuses a beam of highly energetic electrons to examine objects on a very fine scale.**
- **The beam of electrons go through the specimen or onto its surface.**
- **Modern electron microscopes can theoretically achieve a resolution of 0.002 nm.**

# ELECTRON MICROSCOPY



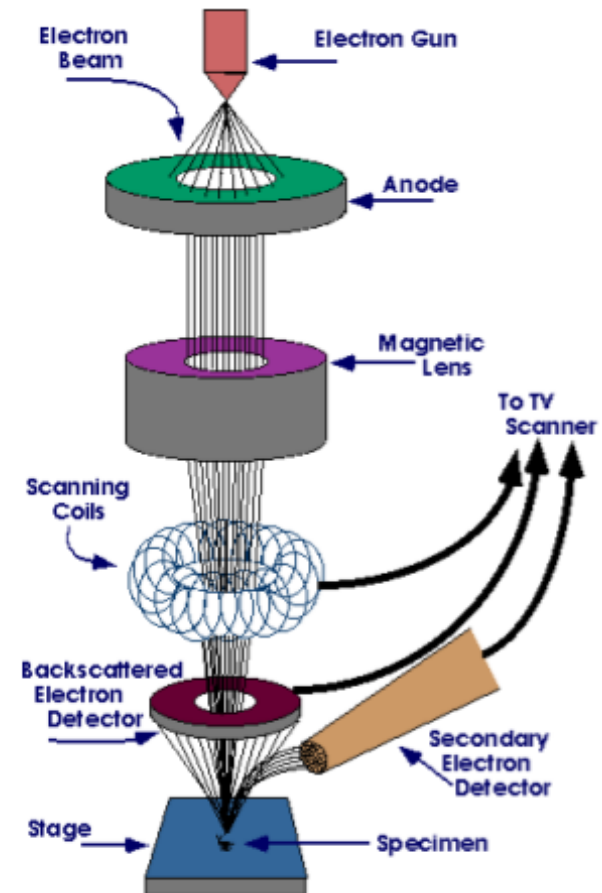
**Processing a sample for Electron Microscopy**

<http://goo.gl/TV59V>

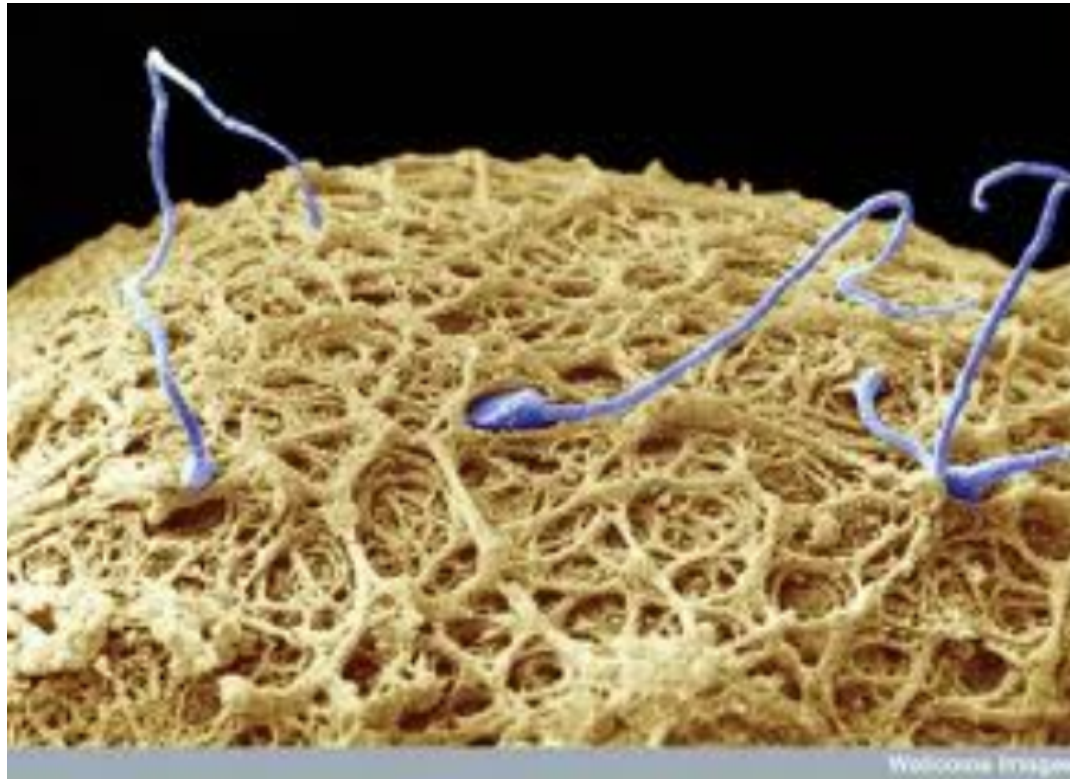
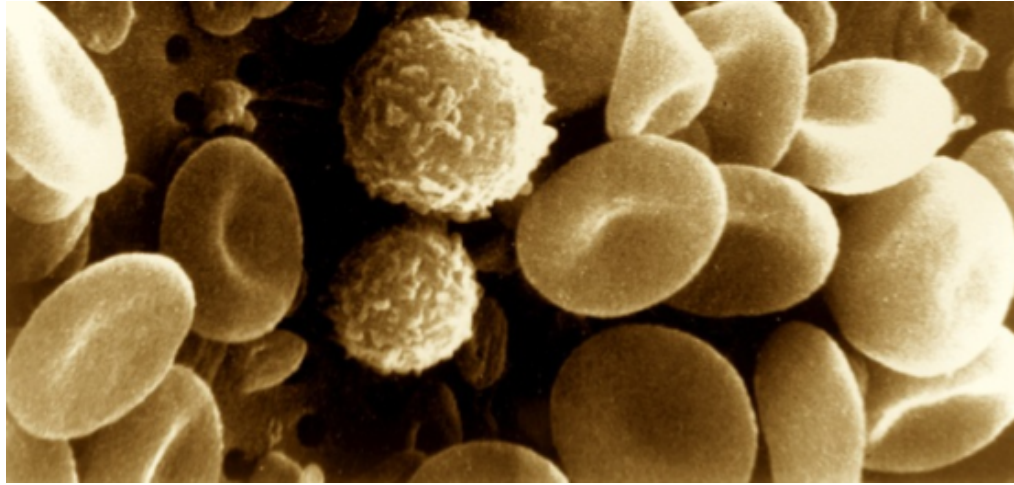
# SCANNING ELECTRON MICROSCOPE (SEM)



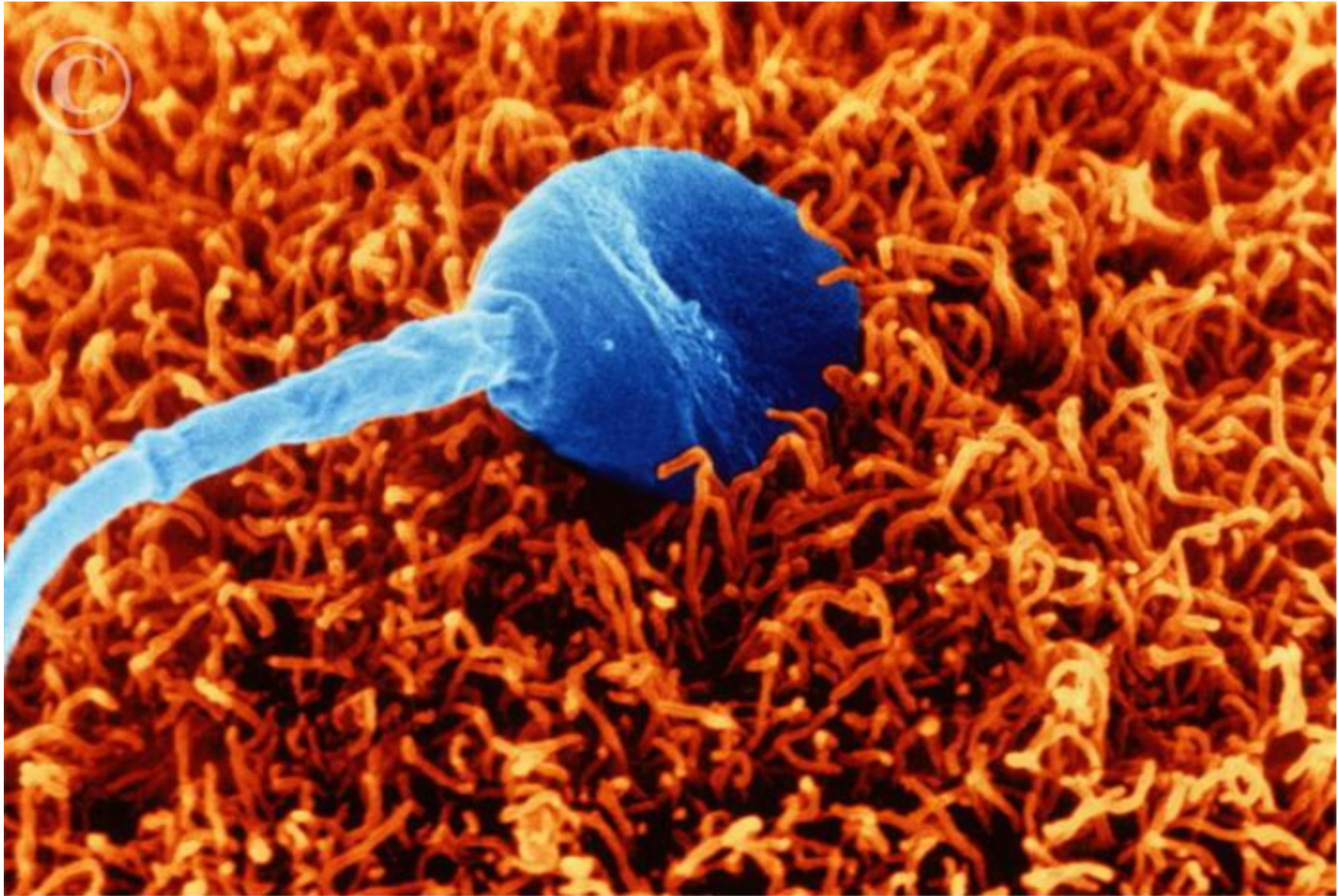
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<http://goo.gl/cPoBG>











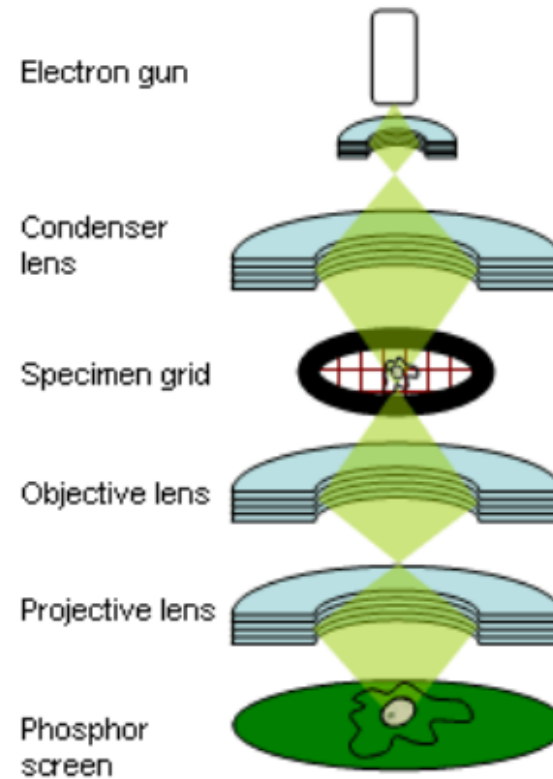
P4441 [RM] © www.visualphotos.com

# TRANSMISSION ELECTRON MICROSCOPE (TEM)

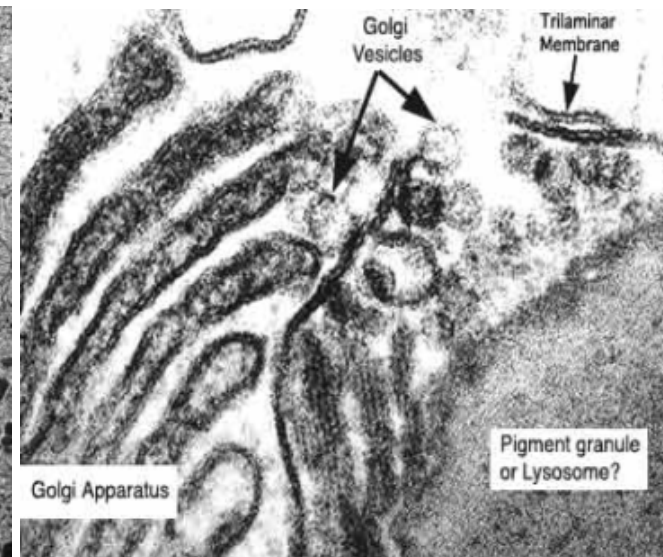
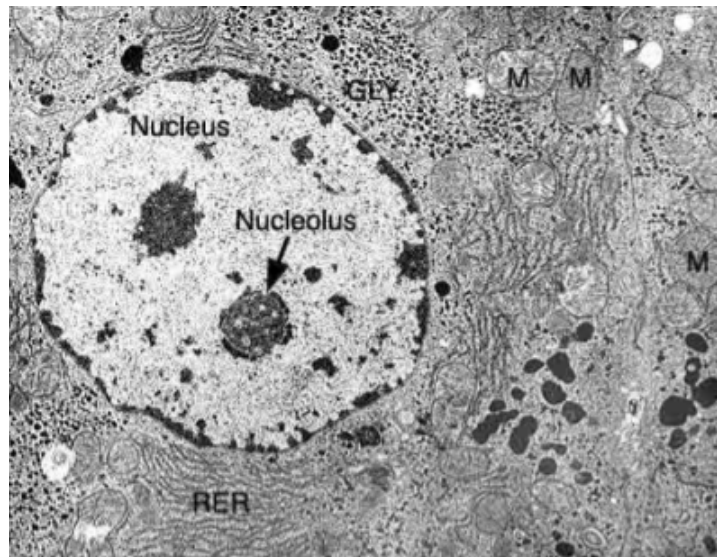
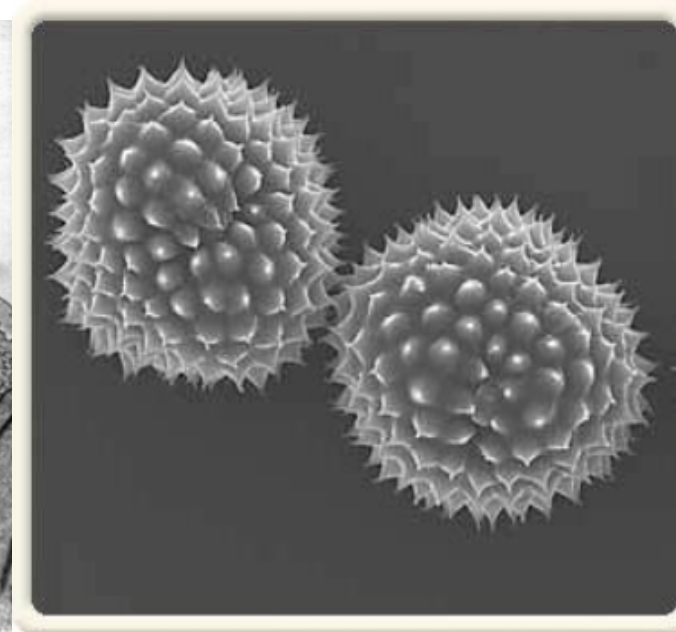
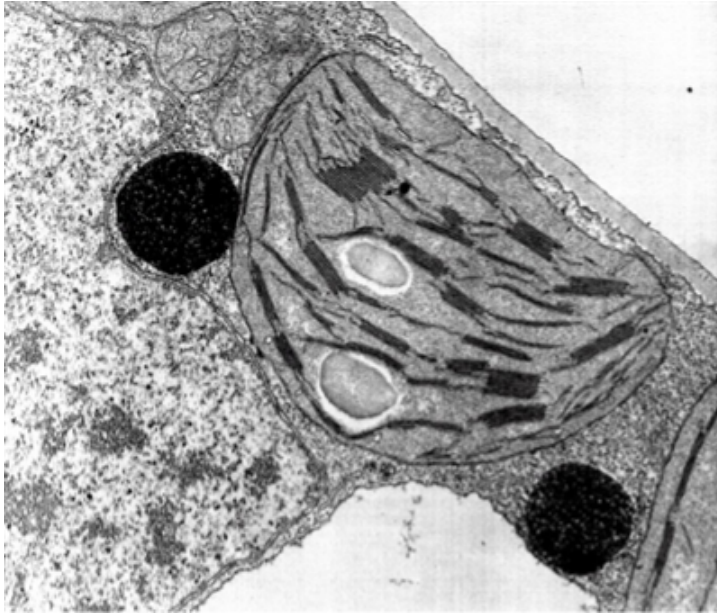
\* TEM



<http://goo.gl/7UpJa>  
<http://goo.gl/TxkCv>







<http://goo.gl/KCy95>

<http://goo.gl/SQQLc>



# Virtual Electron Microscope

<http://goo.gl/X83Rt>



# Comparing Microscopes

<http://goo.gl/VvUQG>



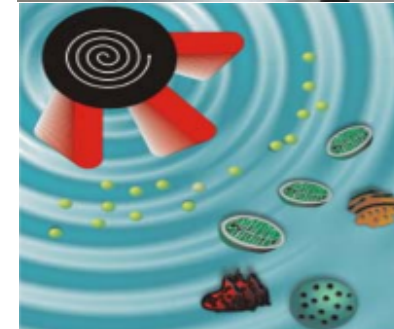
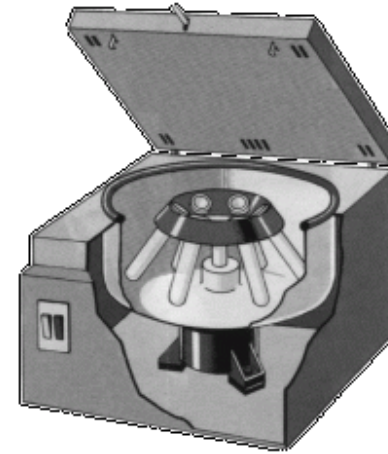
<http://goo.gl/krkkD>



<http://fur.ly/59in>

# Centrifugation

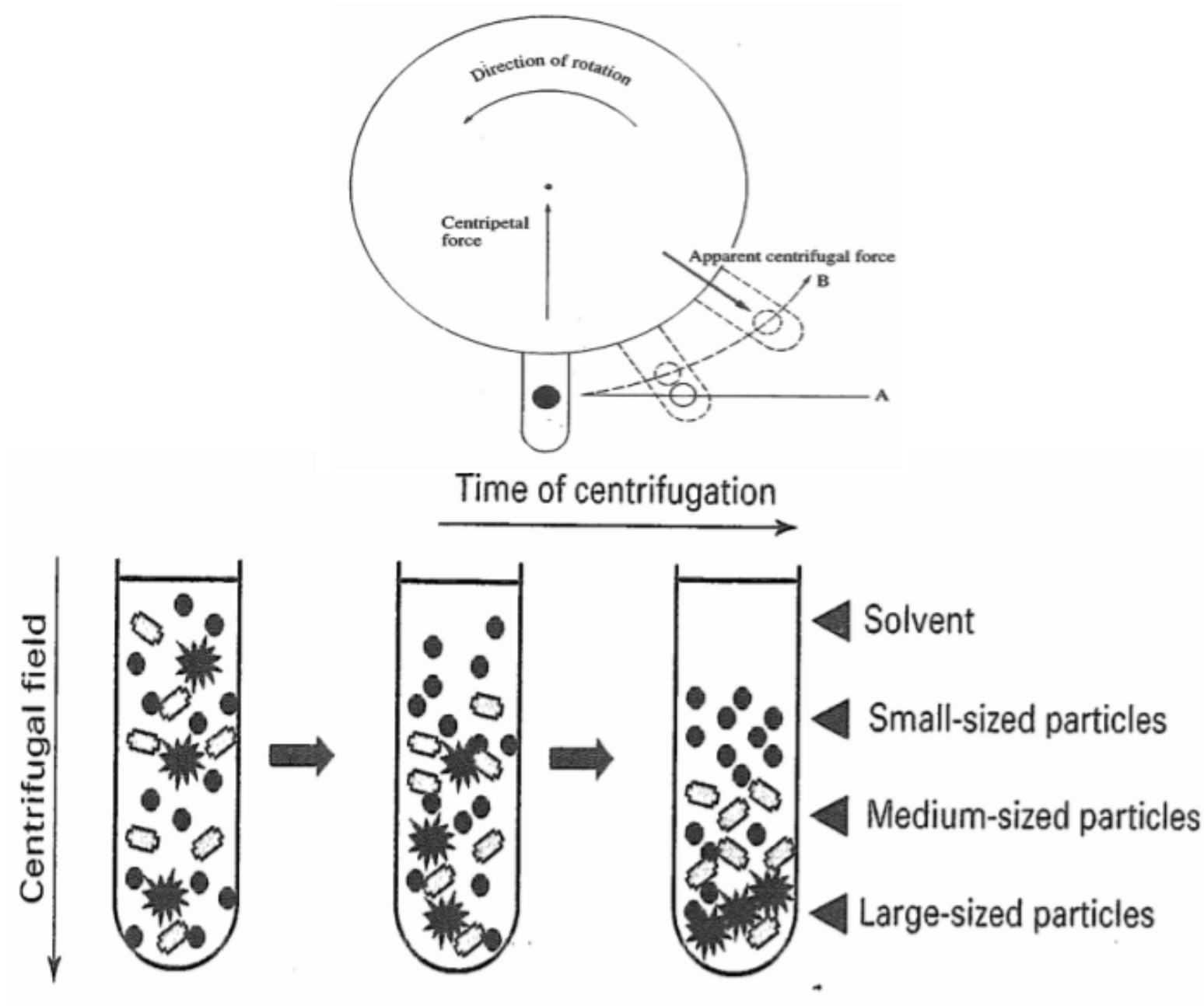
- A centrifuge is a device for separating particles from a solution according to their shape, size, density, viscosity of the medium and rotor speed.
- In a solution, particles whose density is higher than that of the solvent **sink** (sediment), and particles that are lighter than it **float** to the surface.
- The greater the difference in density, the faster they move.
- if there is no difference in density, the particles stay steady.



Adapted from <http://goo.gl/uAkII>

<http://goo.gl/9Cy2w>  
<http://goo.gl/hs1un>







**Centrituge**

<http://goo.gl/hMIQy>

# Incubation

- In Science, an incubator is a device used to grow and maintain microbiological cultures or cell cultures.
- The incubator maintains optimal temperature, humidity and other conditions such as the carbon dioxide (CO<sub>2</sub>) and oxygen (O<sub>2</sub>) content of the atmosphere inside.
- Incubators are essential for a lot of experimental work in cell biology, microbiology and molecular biology and are used to culture both bacterial as well as eukaryotic cells.



<http://goo.gl/oFMp7>

## Teacher's Notes

This class has been designed to cover the topics of *Lab Basics: The Tools of Research* from Monday, March 21st till Friday, March 25th.

For further knowledge about this topic:

1. Conduct a thorough search under the topic: *Lab Basics: The Tools of Research* on the Web, books and magazines.
2. If findings are not specific, ask your teacher for suggestions.

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# Objectives

## General

- Identifies and describes the uses of instruments in scientific investigation.
- Describes the types, functions and uses of the microscope, centrifuge and incubator.

**Note:** *All, or most, of the objectives will be covered during class time, however the student must be responsible for those objectives not covered or concluded.*

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# Vocabulary

Microscope:

Centrifuge:

Incubator:

Humidity:

Lens:

**Note:** *Most of the vocabulary words will be covered during class time, however the student must be responsible for those words not covered or concluded.*

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## Link and Learn

You can visit the following websites to improve your understanding on the present topic:

- <http://goo.gl/KCy95>
- <http://goo.gl/1MkZ1>
- <http://goo.gl/78x0p>
- <http://science-altair.wikispaces.com>
- <http://learningandscience.blogspot.com>

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